

分析化學期末考 2018/01 (正式考試時數字會改)

系級：                      學號：                      姓名：

(考試時間 70 分) (未完整回答或無計算過程不給分)(答題紙只使用一張額外加 3 分)

1. A 0.005-g sample of a rock is to be analyzed, and iron is to be determined at the ppm level. Determine the type of analysis and type of constituent.
  
2. What is the object of sampling step in an analysis?
  
3. Describe the steps in a sampling operation.
  
4. **Define** "internal standard methods" and "standard addition methods"
  
5. In the determination of lead in a paint sample, it is known that the sampling variance is 10 ppm while the measurement variance is 4 ppm. Two different sampling schemes are under consideration:  
  
    **Scheme a:** Take five sample increments and blend them. Perform a duplicate analysis of the blended sample.  
  
    **Scheme b:** Take three sample increments and perform a duplicate analysis on each.  
  
    Which sampling scheme, if any, should have the lower variance of the mean?
  
6. The sulfate ion concentration in natural water can be determined by measuring the turbidity that results when an excess of  $\text{BaCl}_2$  is added to a measured quantity of the sample. A turbidimeter, the instrument used for this analysis, was calibrated with a series of standard  $\text{Na}_2\text{SO}_4$  solutions. The following data were obtained in the calibration for sulfate concentrations,  $c_x$

$c_x$ mg $\text{SO}_4^{2-}$ /L	Turbidimeter Reading, R
0.00	0.06
5.00	1.48
10.00	2.28
15.0	3.98
20.0	4.61

Assume that there is a linear relationship between the instrument reading and concentration

- Compute the least-squares slope and intercept for the best straight line among the points.
- Find the  $R^2$  value and the significance of the regression.

7. 可以使用標準品添加法來偵測土壤樣品中的亞硝酸根含量。將一份 1.00 mL 的樣品水溶液與 24.00 mL 比色法試劑溶液進行混合，而亞硝酸根轉變成一種顯色的產物，經過空白溶液修正之後，這種產物的吸收值等於 0.300。在原始的 50.00mL 樣品溶液中，添加入 1.00 mL  $1.00 \times 10^{-3}$  M 的亞硝酸根標準溶液。此時會進行相同的顯色反應，而且新的吸收值等於 0.530。請計算出在原始未稀釋樣品中的亞硝酸根濃度值等於多少？

8. In a solution of pH 5.3, the indicator bromocresol purple exhibits a yellow color, but when the pH is 6.0, the indicator solution changes to purple. Discuss why these colors are observed in terms of the wavelength regions and colors absorbed and transmitted.

- Calculate the frequency in hertz of
  - an X-ray beam with a wavelength of 2.65 Å.
  - an emission line for copper at 211.0 nm.

- (c) the line at 694.3 nm produced by a ruby laser.
- (d) the output of a CO<sub>2</sub> laser at 10.6 μm.
- (e) An infrared absorption peak at 19.6 μm.
- (f) A microwave beam at 18.6 cm.

10. A sophisticated ultraviolet/visible/near-IR instrument has a wavelength range of 185 to 3000 nm. What are its wavenumber and frequency ranges?
11. A typical simple infrared spectrophotometer covers a wavelength range from 3 to 15 μm. Express its range (a) in wavenumbers and (b) in hertz.
12. A chemical analysis uses only \_\_\_\_\_, the process of sampling is a very important operation.
13. Knowing \_\_\_\_\_ and how to further subdivide the collected sample is vital in the analytical process.
14. Quantitative methods are traditionally classified as \_\_\_\_\_, \_\_\_\_\_, or \_\_\_\_\_.
15. 辨識化學物種的方法—— \_\_\_\_\_，和量測出組成分數量的方法—— \_\_\_\_\_
16. The analysis of real samples is complicated by the presence of the \_\_\_\_\_. The \_\_\_\_\_ can contain species with chemical properties similar to the analyte. If the interferences are caused by extraneous species in the matrix, they are often called \_\_\_\_\_.
17. The collection of sampling units or increments is called the \_\_\_\_\_.
18. For laboratory analysis, the gross sample is usually reduced in size and homogenized to create the \_\_\_\_\_
19. Steps in obtaining a laboratory sample.  
\_\_\_\_\_ → \_\_\_\_\_ → \_\_\_\_\_
20. An analysis of variance can reveal whether the b \_\_\_\_\_ n samples

variation ( \_\_\_\_\_ ) is significantly greater than the within samples variation ( \_\_\_\_\_ ).

21. Well-mixed solutions of liquids and gases require only a very small sample because \_\_\_\_\_

22. For heterogeneous solids, the mass of the gross sample may range from hundreds of grams to kilograms or more. Reduction of the gross sample to a finely ground and homogeneous laboratory sample, of at most a few hundred grams, is necessary.

23. Calibration determines the relationship between \_\_\_\_\_ and \_\_\_\_\_, which is usually determined by the use of chemical standards prepared from purified reagents.

24. A series of standard solutions is prepared separately from the sample.

25. *Finding the least-Squares line*

The least-squares method finds the sum of the squares of the residuals  $SS_{\text{resid}}$  and minimizes the sum using calculus.  $SS_{\text{resid}} =$  \_\_\_\_\_

26. The slope and the intercept are defined as:

$S_{xx}$  \_\_\_\_\_  $S_{yy}$  \_\_\_\_\_  $S_{xy}$  \_\_\_\_\_

Slope  $m =$  \_\_\_\_\_ Intercept  $b =$  \_\_\_\_\_

The coefficient of determination ( $R^2$ ) = \_\_\_\_\_

27. A real blank is either a s \_\_\_\_\_ k, containing the same solvent in which the sample is dissolved, or a r \_\_\_\_\_ k, containing the solvent plus all the reagents used in sample preparation.

28. An I \_\_\_\_\_ d is a reference species, chemically and physically similar to the analyte, that is added to samples, standards, and blanks.

29. The method of s \_\_\_\_\_ s is used when it is difficult or impossible to duplicate the sample matrix. The definition of sensitivity most often used is the c \_\_\_\_\_ y, or the change in the response signal per unit change in analyte concentration.

30. The analytical sensitivity is the ratio of the calibration curve slope to the standard deviation of the analytical signal at a given analyte concentration.
31. The detection limit,  $DL$ , is the smallest concentration that can be reported with a certain level of confidence.
- 32.